

REMARKS

Claims 1-5 are currently pending in the present application. Claim 1 has been amended herein. Support for the present claim amendment may be found in the specification, at least, at paragraphs [0012], [0013], [0014], and [0022]. No new matter has been added by way of the present claim amendments.

Substance of the Examiner Interview

Applicants kindly thank Examiners Singal and Richards for the courtesy of conducting an Examiner Interview with Applicants's representative on February 25, 2009. During the interview, the Examiners explained that the metes and bounds of claim 1 were not clearly set forth. Thus, in the present response, Applicants have amended claim 1 to more clearly set forth the present invention. Applicants invite Examiner Singal to contact the undersigned in the event that the present claim amendments do not serve to overcome the outstanding issues.

Rejection under 35 U.S.C. §103 – Obviousness

Claims 1-5 remain rejected under 35 U.S.C. § 103 as being unpatentable over USP 4,929,564 to Kainosho et al. (hereinafter “Kainosho”) in view of US 2003/0077870 to Yoon et al. (hereinafter “Yoon”).

Claim 1 has been amended to recite the following:

A vapor phase growth method for growing an epitaxial layer on a semiconductor substrate, comprising:

measuring a resistivity of the semiconductor substrate at a room temperature;

setting a heating temperature by radiant heating said semiconductor substrate based on the resistivity of the substrate at room temperature;

adjusting said heating temperature caused by said radiant heating of the semiconductor substrate; and

growing the epitaxial layer, wherein the temperature of a surface of said semiconductor substrate is indirectly controlled by adjusting said heating temperature from said radiant heating. (emphasis added).

Applicants respectfully submit that neither of the cited prior art references teach or suggest each and every element of the presently claimed invention. Specifically, the prior art references do not teach or suggest: (i) indirectly controlling the semiconductor substrate surface temperature by radiant heating; and (ii) the surprising relationship between the semiconductor substrate resistivity and the surface temperature of the semiconductor substrate. Each of these important features of the present invention will be addressed, in turn, below.

Indirect control of the semiconductor substrate surface temperature by radiant heating

In the present invention, the surface temperature of the semiconductor substrate is indirectly controlled by radiant heating the semiconductor substrate. See the present specification, paragraph [0012]. Generally, in a case where an MBE apparatus (or the like) is used, a thermocouple is disposed in between the heater and the substrate, so as to control the heating temperature of the MBE apparatus. In order to obtain an accurate degree of the temperature of the substrate surface, it is preferable to directly measure it *via* pyrometer on the substrate surface.

However, it is difficult to stably control the temperature in this manner when vapor phase epitaxy is performed by MBE apparatus. This is because the molecular beams (and the like) are prone to make the window of the pyrometer misted due to their attachment. Thus, the temperature rise of the substrate surface is indirectly controlled by radiant heating, as recited in present claim 1.

The heating temperature, which is to be set based upon the instruction of the thermocouple, is adjusted according to the difference of the substrate resistivity at room temperature. See present specification, paragraphs [0008] – [0013]. Thus, the actual temperature of the substrate surface is controlled, so as to be a predetermined desired temperature.

Relationship between the semiconductor substrate resistivity and the surface temperature of the semiconductor substrate

Every ingot of a substrate has its own resistivity at a room temperature, which differs slightly from one another. During epitaxial growth, resistivities of an arbitrary substrate at a temperature in the vicinity of the heating temperature may be roughly estimated by mathematical formulae based on the resistivity at a room temperature. However, it should be noted that the resistivity of a substrate at the heating temperature inevitably reflects the differences in resistivity of each ingot at the room temperature.

That is, during epitaxial growth, the difference of the resistivity of an ingot at the room temperature results in the difference in degree of the temperature rise on the substrate surface by receiving radiant heat from an apparatus (e.g., MBE apparatus). Therefore, in order to precisely control the temperature rise on the substrate surface, it is necessary to adjust and change the radiant heat amount supplied from the apparatus.

The superior results of the present invention were achieved based on Applicants' surprising discovery of the relationship between the substrate resistivity and the surface temperature. This relationship provides an effect wherein the epitaxial layer having a stable quality can be grown with superior reproducibility and a semiconductor element having superior characteristic can be manufactured stably. See the present specification, paragraphs [0013] and [0016].

On the contrary, in Kainosho, the variation in the resistivity of the substrate is suppressed by the heat treatment. Kainosho fails to disclose each and every feature of the present invention.

Yoon discloses a method of reducing parasitic capacitance of a device on an HBT epitaxial layer using selective wet etching, which has nothing to do with the vapor phase growth method for growing an epitaxial layer, as in the present invention.

Accordingly, the process of the present invention is entirely different than the disclosures of Kainosho and Yoon, independently or taken together. Therefore, Applicants respectfully submit that the presently claimed invention is non-obvious, in light of the cited prior art. Reconsideration and withdrawal of the outstanding rejection are respectfully requested.

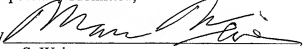
In view of the foregoing, Applicant believes the pending application is in condition for allowance. A Notice of Allowance is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Monique T. Cole, Reg. No. 60,154 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

By 
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